

IN THE DRAWINGS

Please amend the drawings by substituting the appended sheets of formal drawings bearing Figs. 4A, 4B, and 5 for the corresponding drawing sheets currently presented. Figs. 4A and 5 were presented informally by way of amendment on January 16, 2002. Formal drawings corresponding to informal Figs. 4A and 5 are submitted herewith for entry, upon the Examiner's approval. Fig. 4B is newly amended by the addition of lines N normal to the surfaces of the amorphous metal ribbons of which the tooth section 230 and the back iron section 220 are comprised.

REMARKS

The Examiner's withdrawal of the rejection of claims 26 and 36 under the judicially created doctrine of obviousness-type double patenting over claim 1 of US Patent 6,462,456 is noted with appreciation.

The Examiner has objected to the drawings under 37 CFR 1.83(a) as failing to show the top and bottom surfaces with a line normal to the axis of rotation.

Applicants note that a similar objection to the drawings was lodged in the Office Action dated October 16, 2001 and withdrawn in the Office Action of April 17, 2002 in view of applicant's amended drawings bearing Figs. 4A and 5 submitted January 16, 2001. Applicants further note that no further objection to the drawings was raised in the Office Actions of August 16, 2002 and February 13, 2003.

Furthermore, applicants respectfully point to amended Fig. 4A, submitted January 16, 2002, and entered by the Office Action of April 17, 2002, wherein a previously-lodged objection to the Figures was withdrawn. On Fig. 4A are depicted lines normal to the surfaces of the amorphous metal ribbons of which the tooth section 230 and the back iron section 220 are comprised. It is respectfully submitted that these lines, and the supporting description contained in the amended paragraph of the specification also submitted with the January 16, 2002 amendment, properly depict the features of the invention specified in the claims that allegedly is not present. It is submitted that one of ordinary skill in the art would understand the disclosure, further in view of the depiction in Fig. 5 of the axis of rotation of the rotor of applicants' motor. Moreover, since both Figs. 4A and 4B are said to be detailed views of a segment of the stator depicted by Fig. 3 (page 5, lines 25 – 30), it is submitted that one of ordinary skill in the art would understand the normal directions in other views, e.g. that of Fig. 4B, by virtue of the directions depicted in Fig. 4A. Nevertheless, for the sake

of clarity, Fig. 4B has been amended to include lines N depicting lines normal to the surfaces of the amorphous metal ribbons of which the tooth section 230 and the back iron section 220 are comprised. The amendment to Fig. 4B is supported by the disclosure, e.g. at page 6, lines 19 – 25. Consequently, no new matter has been added.

Claims 1 – 36 were rejected under 35 USC 112, first paragraph, as failing to comply with the written description requirement. The Examiner has indicated that the claims contain subject matter which was not described in the specification in such a way as to reasonably convey to one skilled in the relevant art that the inventors, at the time the application was filed, had possession of the claimed invention. In particular, the Examiner alleges that the specification does not contain a full, clear, concise, and exact written description of each strip of the segment having an top and bottom surfaces with a line normal to either surface [that] is substantially perpendicular to the axis of rotation.

Applicants respectfully draw the Examiner's attention to the following statement in the specification at page 6, lines 20 – 22:

“It [the stator] is comprised of elongated amorphous metal strips, i.e. strips having a length and width substantially greater than the thickness thereof. The length and width directions define top and bottom surfaces of the strip.”

Moreover, applicants respectfully submit that one of ordinary skill in the amorphous metals art would recognize that amorphous metals are produced and supplied commercially in the form of continuous ribbons of indefinite length, and having lengths of up to several inches and thicknesses that, in some cases, are as much as about 0.003” but typically are about 0.0007 – 0.0015”. Applicants maintain that one of ordinary skill would acknowledge that the present terms “top surface” and “bottom surface” are used in a conventional manner. That is to say, applicants' usage

accords with nomenclature commonly recognized in the amorphous metals art, either for continuous ribbon in the form in which it is produced and sold in commerce or for shorter sections cut or otherwise derived from a supply ribbon. Applicants further submit that everyday parlance recognizes such a usage for articles that are in the strict sense three-dimensional, but wherein one of the dimensions is substantially less than the other two. For example, everyday parlance would admit that an ordinary sheet of office paper has but two surfaces, the edges of the sheet not being regarded as “surfaces.” With respect to a registered stack of office paper, e.g. a ream, ordinary parlance would also recognize a distinction between: (i) the top and bottom surfaces of the stack and (ii) the edge surfaces of the stack formed by the aligned edges of the individual sheets. Moreover, ordinary parlance would further recognize that the individual sheets retain their identity and would understand each individual sheet as still having a top and a bottom surface, despite being part of a stack.

Applicants also maintain that one of ordinary skill would understand the adjective “normal” as being used in its conventional sense as a term in geometry meaning perpendicular. Such usage is confirmed by the first dictionary definition: “forming a right angle : perpendicular.” *Merriam Webster’s Third International Dictionary* (1993) at 1540. The term “normal” remains meaningful even if the sheet is bent to a curved shape, the perpendicularity being determined with respect to a plane locally tangent to the curved sheet at the point of intersection of the curved surface and the imaginary normal line, in accordance with the principles of elementary geometry.

The Examiner has made the following statement at page 9 of the Office Action dated October 10, 2003:

“The Applicant’s argument that the edge of the strips is not a surface is not persuasive. The drawings of ‘438 show the edge having dimension along the axis of the core, so it is a surface. The Applicant’s argument that the edge is not the ‘top’ or ‘bottom’ surface is not persuasive. The radial inner

and outer surfaces of the segment are *the top and bottom surfaces of the segment*, which is consistent with the plain meaning of the terms because there is nothing above or below those surfaces. The edge surfaces are the top most and the bottom most surfaces of the laminations of the segment. The examiner has included a written description rejection and a drawing objection because the applicant's argued top/bottom surfaces (the ones with the larger surface area) are NOT shown in the drawings or described in the specification to be perpendicular to the axis of rotation. Particularly, the Examiner notes that Figure 4b does not show that a line perpendicular to the top surfaces 231 of the teeth being perpendicular (crossing at 90 degrees) to the axis of rotation." (italics added)

The Examiner's attention is respectfully drawn to Fig. A5, submitted herewith, which is adapted from Fig. A3 as submitted in connection with Applicants' appeal brief dated November 6, 2002. Fig. A5 depicts the magnetic structure provided in the Figure of the '438 patent. For greater clarity, the structure is drawn in end-on, cross-sectional view. Generally stated, the structure comprises four back-iron sections 2 and four pole shoe sections 3. Applicants agree that each of the *segments* that comprise the '438 magnetic structure has plural surfaces. In particular, applicants agree that each section 2 and each section 3, taken as a whole, has a radially inward-facing surface and a radially outward-facing surface. For convenience these surfaces are labeled IS2 and OS2 for sections 2 and IS3 and OS3 for sections 3 in Fig. A5.

However, applicants maintain that the structure of shoe sections 3, as oriented and assembled in a stator in accordance with the Figure of '438, fails to satisfy the configurational requirement of claim 1 and that the Examiner's conclusion otherwise is based on an incorrect reading of the claim. In the portion of the rejection of October 10, 2003 quoted hereinabove, the phrase emphasized speaks of the surfaces of the *segment*, not the surfaces of the *strips*, as delineated by Applicants' claims. Thus, the surfaces labeled IS3 and OS3, while admittedly surfaces of *segments* 3, are not the surfaces of any of the *strips* comprised in the segments 3. Applicants' claims expressly require perpendicular orientation of the surfaces of strip, not surfaces of segments.

Lines normal to surfaces IS3 and OS3 at substantially any point thereof are admittedly perpendicular to the axis of rotation of the rotor. However, shoe segments 3 comprise a plurality of individual layers of (crystalline) magnetic metal strip that are stacked in registry. Each of the layers in the Fig. A5 configuration is identical in shape and has a top surface and a bottom surface. Lines normal to the layers comprised in segments 3 at any point thereon are submitted to be *parallel* to the rotation axis, i.e., perpendicular to the page of Fig. A5, and not *perpendicular* to the rotation axis, as required by claim 1.

It is established law that during examination, claims are to be interpreted using the broadest reasonable interpretation consistent with the specification, but that the broadest interpretation must also be consistent with what persons of ordinary skill would conclude. *In re Cortright*, 165 F.3d 1353, 1359, 49 USPQ2d 1464, 1468 (Fed. Cir. 1999) and MPEP 2111. Moreover, it is also established that terms used in the claim are to be given their ordinary meaning unless another definition is provided by the specification. (“As we have repeatedly said, a patentee can be his own lexicographer provided the patentee's definition, to the extent it differs from the conventional definition, is clearly set forth in the specification.” *Beachcombers Int’l, Inc. v. Wildewood Creative Prods., Inc.*, 31 USPQ 2d 1653, 1656 (Fed. Cir. 1994)). In the present instance, it is submitted that the teaching at page 6, lines 20 – 22 and at Fig. 4A as amended on January 16, 2002 and entered by way of the Office Action dated April 17, 2002, provides a definition of “top surface” and “bottom surface” of a strip that would be clearly understood by one of ordinary skill. Applicants respectfully submit that each occurrence of the terms “top surface of a strip” and “bottom surface of a strip” must be understood in a manner consistent with the definitions of those terms provided by applicants’ specification. Applicants respectfully submit that the Examiner has understood these terms otherwise.

The Examiner further states at page 9 of the October 10, 2003 Office Action that:

“The Applicant’s argument that all the segments do not have a surface perpendicular to the axis of rotation is not persuasive. ‘438 shows all the segments having surfaces with a line normal to the axis of rotation being perpendicular to the axis of rotation, those being the radially inner and outer surfaces of sections 2 and 3. The examiner notes that the claims are over broadly drafted, there is not limitation that the top and bottom surfaces of the pole section 2 and the curved section 2 are both the largest surface area surfaces of the strip.”

Applicants respectfully submit that the Examiner has not correctly represented Applicants’ argument. In particular, Applicants have consistently argued that the perpendicularity is to be reckoned with respect to the surface of the strips contained in a segment and not with respect to any other surface, such as a surface defined by the edges of stacked sheet material that collectively form a segment, as one would infer from the first sentence of the above quotation. Applicants further traverse the Examiner’s contention that “the claims are over broadly drafted” and submit that the claims, properly construed in light of the totality of the specification’s teachings and in accordance with relevant case law, are patentable over the art applied. More specifically, applicants maintain that the operative legal standard is not the breadth of the claims, and that the limitation proposed by the Examiner does not correctly reflect the limitations inherent in the instant claims, properly construed in light of the specification.

Still further, applicant traverses the Examiner’s statement in the first paragraph of page 10 of the October 10 Office Action which equates the radially inner and outer surfaces of the poles of ‘438 surfaces with the top and bottom surfaces. As best understood by applicants, the Examiner’s references to radially inner and outer surfaces are to the surfaces designated as IS3 and OS3 in Fig. A5. As set forth hereinabove, this equation is precluded by applicants’ definition at page 6, lines 20 – 22, of the top and bottom surfaces of the strips contained in applicants’ magnetic structure.

The Examiner further mischaracterizes applicants' argument by inferring that "the Applicant wishes to claims *[sic]* to include the limitation of the surfaces with the largest surface area being the top and bottom surfaces, but that limitation is NOT in the claims." (page 10, lines 8 – 9). With respect, applicants have not made such a representation. Rather, applicants have specified the configuration of the strips that are assembled, e.g. to form the stator of claim 1, with reference to the surface of the individual strips. None of the claims is restricted by the relative area of any surface of the overall segment, and applicants submit that no such limitation is needed to patentably define over the art applied.

Accordingly, the Examiner's objection to the drawings and rejection of the claims under 35 USC 112, first paragraph, is not proper; reconsideration thereof is respectfully requested.

Claims 1, 2, 3, 8, 19-22, and 35 have been rejected under 35 U.S.C. § 103(a) as being unpatentable over German Patent Document 28 05 438 (the "438 patent") and U.S. Patent No. 4,255,684 to Mischler et al.

The rejection includes the following statement in paragraph 5:

"438 teaches a stator for a motor having a plurality of segments (one pole section and one backiron section) where the flux must cross an air gap between free ends of a tooth section 3 and a back iron section 2. Each segment is formed of a plurality⁷ of strips (the backiron sections stacked radially and the teeth sections stacked axially, *where the inner and outer surfaces of each section is a top and bottom surface of the strip.*" (emphasis added)

Applicants respectfully traverse the highlighted clause, in that the Examiner has relied on a definition of the terms "top surface" and "bottom surface" [of a strip] that is not compatible with the definition of those terms that must be applied in construing the meaning of applicants' claims 1, 2, 3, 8, 19-22, and 35. Applicants submit that in view of the specification at page 6, lines 20-22, the edge of a single strip of thin, sheet-form magnetic metal (either amorphous or crystalline) would not

and cannot be construed as a top or bottom surface of the strip by one of ordinary skill in the art. Furthermore, neither can or would any surface defined by the nominally aligned edges of plural stacked strips properly be construed as a top or bottom surface of strip. The Examiner clearly recognizes that the layers of the teeth sections are stacked axially, so that the top and bottom surfaces, as defined by applicant, have normal directions that are axial, contrary to the requirement of claims 1, 2, 3, 8, 19-22, and 35. As a result, applicants maintain that the '438 publication fails to disclose or suggest any stator having the geometrical structure and configuration required by applicants' claims.

Moreover, applicants respectfully submit that the '438 patent in fact teaches away from applicants' configuration. At page 14, lines 17 – 19, the '438 reference states: "Dabei sind die Einzelblechlagen 2a und 3a an den Stoßstellen rechtwinklig zueinander vorgesehen, d. h. sie kreuzen sich gitterartig." *[The individual sheet metal laminae 2a and 3a are disposed at right angles to each other at the abutment locations, that is to say, they cross each other in a lattice-like configuration.]*

Applicants are unaware of any disclosure by the '438 patent of other embodiments in which the laminations are not in perpendicular abutment as set forth both in the aforecited passage and in the Figure, and the Examiner has not pointed to any. Inasmuch as no structure satisfying the requirements of amended claims 1, 2, 3, 8, 19-22, and 35 is disclosed or suggested by the combination of the '438 and Mischler et al. patents, applicant's respectfully submit that the claims are not properly subject to a rejection under 35 USC 103(a).

The Examiner has acknowledged that the '438 German Patent does not disclose a stator comprised of amorphous metal, and so has proposed to combine the Mischler et al. reference. The Examiner has indicated that Mischler et al. teaches a stator for a motor with a plurality of segments

formed from amorphous metal. Applicants respectfully traverse this indication. For example, Figure 1 of the Mischler reference depicts a stator having yoke structures 11 and 12 constructed of layers of continuous flat amorphous strip 13 and amorphous composite pole pieces 18 and 19. These pole pieces are not constructed of amorphous metal strips, and are instead said to be “amorphous metal flake or filament composite in a binder” (col. 1, lines 63-64). The path of magnetic flux is labeled “FLUX” in Figure 1 and clearly is seen not to traverse any air gap.

By way of contrast, the stator of present claim 1 is comprised of segments, each of which comprises a plurality of layers of amorphous metal strips. Moreover, flux traversing the segment crosses one air gap. Neither of these conditions is satisfied by any stator disclosed or suggested by Mischler et al. Accordingly, the structure of applicants’ claimed stator is not suggested by Mischler or the ‘438 German Patent, either individually or collectively. In this respect, Mischler et al. does not suggest a modification of any structure taught by the ‘438 reference which would produce the stator required by each of applicants’ claims 1, 2, 3, 8, 19-22, and 35.

Applicants maintain that the ‘438 patent fails to disclose or suggest any embodiment of a stator satisfying the geometrical limitations required by applicants’ claims 1, 22, and 35.

Applicants’ claimed stator has exceptional magnetic properties, notably including low core loss, that render a motor constructed therewith highly efficient and capable of high-speed operation not possible with motors incorporating previously known magnetic components. As a result, a motor constructed with the presently claimed stator achieves higher power than previous motors of the same size and weight, while retaining higher efficiency. Moreover, the structure of the stator lends itself to highly efficient and cost-effective manufacture; and is especially suited to be incorporated into a highly efficient electric motor.

In addition, the Mischler et al. limitation that the flux does not jump an air gap places severe restrictions on the performance of their motor. If a continuous segment of the Mischler et al. motor is magnetized (for example, the segment 38 in Mischler et al.'s Fig. 7), then only the right half of the 12 o'clock tooth and the top half of the 3 o'clock tooth are magnetized. The other halves of the 12 o'clock and 3 o'clock teeth represent parts of different, unmagnetized, segments. Effectively, only half of the volume of each tooth is magnetized. Therefore, if segment 38 is magnetized to 1.5 T, the 12 o'clock tooth will perform as if the entire tooth were magnetized to only 0.75T. This would provide half the torque of a tooth fully magnetized to 1.5T.

Clearly, the Mischler et al. limitation that the flux does not jump an air gap places restrictions on the combinations of frequency, speed and torque at which their motor operates. These restrictions, which have heretofore made amorphous metal stators unsuitable for conventional motor applications, have been eliminated by the stator called for by present claims 1, 2, 3, 8, 19-22, and 35. In contrast to the teaching the '438 patent, as modified by Mischler et al., the stator called for by applicants' claims 1, 2, 3, 8, 19-22, and has backiron and teeth constructed such that radial flux passing through the stator crosses just one air gap when traversing each segment of the stator. Overall versatility of the motor is improved; operational ranges and levels of speed, frequency and torque are increased. When compared with any stator constructed from the combined teachings of the '438 patent and Mischler et al., the stator recited by present claims 1, 2, 3, 8, 19-22, and 35 is smaller, lighter, much less expensive to construct and far more versatile and efficient in operation.

Applicants respectfully submit that it was not obvious to manufacture an amorphous metal rotor having the structure of the '438 patent. Had it been obvious to do so, Mischler et al. and other prior art workers would have attempted to combine the teachings of the known art and realized the significant advantages afforded by the stator delineated by applicants' claims. Clearly, up to the

time of applicants' invention, no amorphous metal stator having the structure called for by claims 1, 2, 3, 8, 19-22, and 35 has been proposed by any prior art worker, including those represented on the '438 disclosure and Mischler et al. The prior art stators and their attendant disadvantages are discussed at pages 1 and 2 of the specification. It is submitted that the proposed combination of the '438 disclosure and Mischler et al. can be made only in light of applicants' own disclosure. Even then, any stator constructed from the combined teachings of the '438 disclosure modified in light of Mischler et al. would require substantial reconstruction and redesign which is not fairly taught by the references.

Assuming, arguendo that the '438 patent could be combined with Mischler et al., the resultant stator would still not possess a plurality of segments, each segment comprising a plurality of layers of amorphous metal strips, each of which has a top and a bottom surface and is oriented such that (i) a line normal to either of said surfaces at substantially any point thereon is substantially perpendicular to the axis of rotation of said rotor, and (ii) when traversing said segment, said flux crosses one air gap, as called for by applicants' claims 1, 2, 3, 8, 19-22, and 35.

Rather, any stator constructed from the teachings of the cited references would be governed by Mischler's limitation that the flux does not jump an air gap. Restrictions placed on the combinations of frequency, speed and torque of such a stator by this limitation would render it unsuitable for many conventional motor applications. These restrictions have been eliminated by the amorphous metal stator called for by applicants' claims 1, 2, 3, 8, 19-22, and 35, which is smaller, lighter, less expensive to construct and more versatile and efficient in operation than any stator produced from the combined teachings of the cited references.

The Examiner has further indicated that heat treatment, application of a magnetic field, and annealing are methods of making limitations not germane to the patentability of the apparatus.

Applicants respectfully submit that heat treatment or annealing, whether or not a magnetic field is applied, structurally alters the stator recited in claims 19-21 and is thus properly germane to the determination of patentability of those claims. As set forth in the specification, e.g. at page 15, lines 7-16, heat treatment enhances the magnetic properties of the amorphous metal strip used in constructing the stator recited by claims 19-21. Moreover, the specification teaches that different forms of heat treatment result in different microstructures within the metal strip. The heat treatment recited at page 15, lines 10-11 modifies a substantially glassy or amorphous microstructure, whereas the heat treatment presented at page 15, lines 17-19 results in the formation of a nanocrystalline microstructure characterized by the presence of a high density of grains having average size less than about 100 nm. The specification teaches that each of these methods constitutes means for improving the magnetic properties of the amorphous metal strip, notably the core loss. A motor comprising a stator having low core loss operates with high efficiency and speed, low production of waste heat, and minimized need for auxiliary cooling means. The significance of low core loss is set forth in the specification, especially at page 16, line 30, through page 17, line 7, and is further discussed hereinbelow in conjunction with the rejection of claims 15-18 and 26-33 over the '438 patent and Mischler et al.

Applicants respectfully submit that claims 19 – 21 are not properly regarded as being necessarily in “product-by-process” as the Examiner has apparently concluded. (“That a process limitation appears in a claim does not convert it to a product by process claim. *Fromson v. Advance Offset Plate, Inc.*, 219 USPQ 1137, 1141 (Fed. Cir. 1983)). It is well established that a process-like limitation may properly be present in a product claim. *In re Moore*, 439 F.2d. 1232, 169 USPQ 239 (C.C.P.A. 1971). This precept was further amplified by the same court in *In re Garnero*, 162 USPQ 221, 223 (C.C.P.A. 1969) [referenced also in MPEP 2113, second paragraph]:

However, it seems to us that the recitation of the particles as “interbonded one to another by interfusion between the surfaces of the perlite particles” is as capable of being construed as a structural limitation as “intermixed,” “ground in place,” “press fitted,” “etched,” and “welded,” all of which at one time or another have been separately held capable of construction as structural, rather than process limitations.

The *Garnero* finding is also acknowledged in MPEP 2113, second paragraph. Accordingly, applicants respectfully traverse the Examiner’s conclusion that heat treatment, application of a magnetic field, and annealing are method of making limitations that are not germane to the patentability of the apparatus.

Moreover, claims 19 to 21 depend from claim 1, which is submitted to be patentably unobvious over any combination of Mischler et al. and the ‘438 German patent, for the reasons set forth hereinabove. It is therefore submitted that dependent claims 19 to 21 are also patentable for at least the same reasons.

In view of the above remarks, applicants respectfully submit that the structural features of the stator are correctly characterized by claims 19-21 and provide proper basis defining patentably over the cited references. Further, it is submitted that the advantageous features afforded by the stator of present claims 1, 2, 3, 8, 19-22, and 35, including significant reductions in size and weight, lower construction costs and increased versatility and efficiency of operation, provide ample basis upon which to predicate their patentability over the art applied.

Accordingly, reconsideration of the rejection of claims 1, 2, 3, 8, 19-22, and 35 under 35 U.S.C. §103(a) as being unpatentable over the ‘438 patent and Mischler et al. is respectfully requested.

Claims 4, 5, and 23 have been rejected under 35 U.S.C. §103(a) as being unpatentable over the ‘438 disclosure and Mischler et al. in further view of U.S. Patent No. 2,556,013 to Thomas, which discloses dynamoelectric motors having stator members provided with salient field poles.

The stators have an outer cylindrical protective and retaining member, which is made of a non-magnetic material with good tensile strength qualities such as aluminum or stainless steel.

The Examiner has indicated that the '438 patent and Mischler et al. teach every aspect of the invention except a steel band peripherally around the stator. This indication is, respectfully, traversed.

As discussed hereinabove in connection with the 103(a) rejection of claims 1, 2, 3, 8, 19-22, and 35 over the '438 patent and Mischler et al., amended claim 1 calls for a stator comprised of segments, each of which comprises a plurality of layers of amorphous metal strips, wherein each of the strips has a top and a bottom surface and is oriented such that (i) a line normal to either of the surfaces at substantially any point thereon is substantially perpendicular to the axis of rotation of the rotor, and (ii) when traversing the segment, the flux crosses one air gap. Even taking the '438 patent and Mischler et al. teaching together, there is not produced any suggestion whatsoever concerning a stator that satisfies the combined requirements of provisos (i) and (ii).

The Examiner has indicated that it would be obvious to construct a stator of the type defined by the '438 patent and Mischler et al. with the steel band disclosed in Thomas. Like Mischler et al., Thomas does not disclose or suggest an amorphous metal stator wherein the flux crosses only one air gap. Thomas also teaches a stator composed of stacked laminations, each having a surface whose normal is parallel, not perpendicular, to the axis of rotation of the rotor with which the stator is associated. Further, Thomas does not teach an amorphous metal stator that is not brittle, and which exhibits increased magnetic permeability and overall efficiency without adverse thermal characteristics. In this respect, Thomas does not add to the teaching of the '438 patent and Mischler et al. and cannot be combined therewith to render obvious the invention recited by amended claims 4, 5, and 23. When compared to any stator constructed in view of the teaching of the '438 patent,

modified in light of Mischler et al. and further modified in light of Thomas, the stator required by amended claims 4, 5, and 23 exhibits increased economy of construction and improved operating versatility and efficiency.

Accordingly, reconsideration of the rejection of amended claims 4, 5, and 23 as being unpatentable over the '438 patent, Mischler et al. and Thomas is respectfully requested.

Claims 6, 7, 24, and 25 were rejected under 35 U.S.C. § 103(a) as being unpatentable over the '438 patent, Mischler et al., Thomas, and further in view of U.S. Patent No. 3,591,819 to Laing.

The Examiner has indicated that the '438 patent, Mischler et al., and Thomas teach every aspect of the invention except the bonding material being an epoxy resin and the inner restraining member being a bonding material and a metal band. For the reasons set forth above in conjunction with the rejection of claims 4, 5, and 23 under 35 U.S.C. § 103(a) over the '438 patent, Mischler et al., and Thomas, applicants respectfully traverse this statement. It is submitted that Thomas does not cure the lack of disclosure in the '438 patent and Mischler et al. concerning a stator comprising amorphous metal strips oriented such that (i) a line normal to either of the surfaces at substantially any point thereon is substantially perpendicular to the axis of rotation of the rotor, and (ii) when traversing the segment, the flux crosses one air gap.

The Examiner has indicated that it would be obvious to construct the stator of the '438 patent, Mischler et al. and Thomas with the synthetic resin taught by Laing. Applicants submit that even if the combination proposed by the Examiner were made, such a stator would lack the advantageous structure and properties exhibited by the stator defined by claims 6, 7, 24, and 25.

Like Mischler et al. and Thomas, Laing does not disclose or suggest amorphous metal stators wherein the flux crosses only one air gap. Like Thomas, Laing also teaches a stator composed of stacked laminations, each having a surface whose normal is parallel, not perpendicular, to the axis

of rotation of the rotor with which the stator is associated. Further, Laing does not teach an amorphous metal stator which is not brittle, and which exhibits enhanced magnetic permeability and overall efficiency without adverse thermal characteristics. In this respect, Laing does not add to the teachings of the '438 patent, Mischler et al. and Thomas, and cannot be combined therewith to render obvious the invention recited by present claims 6, 7, 24, and 25. Any stator constructed from the combined teachings of the '438 patent, Mischler et al., Thomas and Laing would lack the structure and advantageous properties of the stator delineated by present claims 6, 7, 24, and 25, and as such would be far more expensive to construct and operate.

The Examiner has further indicated that Laing teaches a laminated stator having a plurality of sections, where the sections are held together by a synthetic resin and a rivet. However, applicants respectfully traverse the Examiner's equation of the Laing rivet with the metal band required by applicants' amended claims 7 and 25. A "rivet" is defined by *Merriam Webster's Third International Dictionary* as: "a headed pin or bolt of some malleable material (as wrought iron, mild steel, or copper) used for uniting two or more pieces by passing the shank through a hole in each piece and then beating or pressing down the plain end so as to make a second head," whereas a "band" is: "a thin flat encircling strip, strap, or flat belt of material serving chiefly to bind or contain something." It is respectfully submitted that the rivet of Laing clearly does not disclose or suggest the band required by claims 7 and 25.

As set forth above in connection with the rejection of claims 4, 5, and 23, even in combination, the '438 patent, Mischler et al., and Thomas references fail to disclose applicants' claimed structure as recited by independent claims 1 and 22, from which amended claims 6, 7, 24, and 25 depend. The Examiner has not pointed to any teaching in Laing that cures this deficiency or any suggestion in Laing that would motivate a skilled artisan to modify the combined teaching of the

'438 patent, Mischler et al., and Thomas references to produce the structures required by present claims 6, 7, 24, and 25.

Accordingly, reconsideration of the rejection under 35 USC 103(a) of claims 6, 7, 24, and 25 as being unpatentable over the '438 patent, Mischler et al., Thomas and Laing is respectfully requested.

Claims 9 and 34 have been rejected under 35 USC 103(a) as being unpatentable over the '438 patent and Mischler et al. in further view of U.S. Patent No. 4,197,146 to Frischmann. The Examiner has indicated that it would have been obvious to construct the stator of the '438 patent and Mischler et al. with the amorphous metal composition disclosed in Frischmann.

Like Mischler et al., Frischmann does not disclose or suggest an amorphous metal stator wherein the flux crosses only a minimum number of air gaps. In addition, the stator disclosed by Frishmann requires that the flux cross many air gaps, that is, the gaps between the compacted, discontinuous flakes. As a result, the Frischmann stator is inherently incapable of exhibiting enhanced magnetic permeability and overall efficiency without adverse thermal characteristics. While Frischmann discloses an amorphous metal composition for fabricating electrical magnetic components, his stator lacks the advantageous features afforded by the stator called for by applicants' present claims 9 and 34. Moreover, Frischmann does not remedy the lack of disclosure in the '438 patent and Mischler et al. concerning the particular orientation of amorphous metal strips called for by amended claims 9 and 34. In these respects, Frischmann does not add to the teaching of the '438 patent and Mischler et al., and cannot be combined therewith to render obvious the invention recited by amended claims 9 and 34.

Accordingly, reconsideration of the rejection of claims 9 and 34, as amended, under 35 U.S.C. §103(a) over the '438 patent, Mischler et al. and Frischmann is respectfully requested.

Claims 10 and 11 have been rejected as being unpatentable over '438 patent, Mischler et al., and Frischmann in further view of U.S. Patent No. 4,409,041 to Datta et al. The Examiner has indicated that '438 patent, Mischler et al., and Frischmann teach every aspect of the invention except the FeBSi formula and that it would have been obvious to construct the stator of '438 patent, Mischler et al., and Frischmann with the amorphous metal set forth in claims 10 and 11, because Datta et al. suggest the disclosed compositional range, as well as the disclosed range for enhancing the composition's magnetic properties.

The Examiner's indication that the '438 patent, Mischler et al., and Frischmann teach every aspect of the invention except the FeBSi formula is respectfully traversed, for the reasons set forth above in connection with the remarks on the rejection of claims 9 and 34 under 35 U.S.C. §103(a).

The Datta et al. disclosure is directed to an iron-based, boron containing magnetic alloy having at least 85 percent of its structure in the form of an amorphous metal matrix annealed in the absence of a magnetic field at a temperature and for a time sufficient to induce precipitation therein of discrete particles of its constituents. No disclosure or suggestion is provided by Datta et al. of the desirability of using amorphous metal in the construction of electric motor components. Moreover, the disclosure of magnetic properties found in Datta et al. is directed to high frequency properties. Each of the examples in Datta et al. discloses properties measured on a magnetic core having a closed magnetic path and carried out e.g. at a frequency of 50 kHz and at an induction level of 0.1 T. One skilled in the art would recognize that losses measured in an open magnetic circuit are higher than those seen in a closed path, as discussed in more detail by applicants in the specification at page 17, lines 20-31.

Clearly the Datta et al. disclosure is directed to core applications, not to motors or other rotating devices. Applicants thus submit that one of ordinary skill would not be motivated to

combine the Datta et al. disclosure with any of the '438 patent, Mischler et al., and Frischmann. However, even assuming arguendo that the combination of the '438 patent, Mischler et al., and Frischmann with Datta et al. were to be made, the resulting stator would still lack the advantageous structure and properties afforded by applicants' stator, as recited by amended claims 10 and 11. More specifically, the stator would not have in combination a structure having a plurality of layers of amorphous metal strips, each of which has a top and a bottom surface and is oriented such that (i) a line normal to either of the surfaces of the strips at substantially any point thereon is substantially perpendicular to the axis of rotation of the rotor, and (ii) when traversing the segment, the flux crosses one air gap. As a consequence, any stator constructed from the combined teachings of the cited references would lack the advantageous magnetic properties, including high induction and low material cost (see page 14, line 29, to page 15, line 5 of applicants' specification) afforded by the stator of present claims 10 and 11. For these reasons, applicants respectfully submit that the stator recited by claims 10 and 11, as amended, is patentable over any combination of the '438 patent, Mischler et al., Frischmann, and Datta et al.

Accordingly, reconsideration of the rejection of present claims 10 and 11 under 35 U.S.C. §103(a) is respectfully requested.

Claim 12 has been rejected under 35 U.S.C. §103(a) as being unpatentable over of the '438 patent, Mischler et al., and Frischmann, in further view of U.S. Patent No. 5,922,143 to Vernin et al. The Examiner has indicated that the '438 patent, Mischler et al., and Frischmann, teach every aspect of the invention except nanocrystalline microstructure.

The Vernin et al. patent discloses a process for manufacturing a magnetic core made of an iron-based soft magnetic alloy having a nanocrystalline structure. The alloy is formed into a toroidal magnetic core and heat-treated based on particular conditions determined on the basis of the use

envisaged for the magnetic core. No suggestion or disclosure is provided in the Vernin et al patent of application of nanocrystalline alloys in motors or other rotating electrical machinery. As discussed hereinabove in connection with the rejection of claims 10 and 11 over the '438 patent, Mischler et al., and Frischmann, in further view of U.S. Patent No. 4,409,041 to Datta et al., applicants submit that one of ordinary skill would not be motivated to combine the Vernin et al. disclosure, which is directed to magnetic core applications, with any of the '438 patent, Mischler et al., and Frischmann, each of which discloses aspects of electric motor construction.

However, even if the Examiner's proposed combination of Vernin et al. with the '438 patent, Mischler et al., and Frischmann were to be combined with Vernin et al. in the manner proposed by the Examiner, the resultant device would still not suggest the stator called for by applicants' present claim 12. As discussed hereinabove, applicants' claims call for a stator comprised of segments, each of which comprises a plurality of layers of amorphous metal strips, each of which has a top and a bottom surface and is oriented such that (i) a line normal to either of the surfaces at substantially any point thereon is substantially perpendicular to the axis of rotation of the rotor, and (ii) when traversing the segment, the flux crosses one air gap. None of the cited references or any combination thereof suggests this combination of structural features. In contrast, the presence of these features in applicants' stator as recited by amended claim 12 results in low core loss and thus a motor that is smaller, lighter, less expensive to construct and more versatile and efficient in operation than a motor employing a prior art stator.

As previously discussed, the low value of core loss afforded by the present stator results in a motor that is more efficient, generates less waste heat that must be dissipated, and is capable of higher speed operation than a motor employing any conventional steel core material. As discussed in detail by the specification, e.g. at page 16, lines 18-19 and 27-29, stators employing

nanocrystalline alloy strip are especially preferred for motors wherein minimum size and high speed operation are desired.

It is therefore submitted that the proposed combination of Vernin et al. with the '438 patent, Mischler et al., and Frischmann, even if proper, does not disclose or suggest the stator recited by present claim 12.

Accordingly, reconsideration of the rejection of claim 12 under 35 U.S.C. §103(a) as being unpatentable over the combination of the '438 patent, Mischler et al., Frischmann, and Vernin et al., is respectfully requested.

Claims 13 and 14 have been rejected under 35 U.S.C. §103(a) as being unpatentable over the '438 patent, Mischler et al., Frischmann, and Vernin et al., in further view of U.S. Patent 4,881,989 to Yoshizawa et al. The Examiner has indicated that the '438 patent, Mischler et al., Frischmann, and Vernin et al. teach every aspect of the invention except the compositions set forth in claims 13 and 14 and that it would be obvious to construct the stator of the '438 patent, Mischler et al., Frischmann, and Vernin et al. with the compositions of claims 13 and 14.

Yoshizawa et al. discloses an iron-base soft magnetic alloy having a composition represented by the general formula: $(\text{Fe}_{1-a}\text{M}_a)_{100-x-y-z-\alpha-\beta-\gamma}\text{Cu}_x\text{Si}_y\text{B}_z\text{M}'_\alpha\text{M}''_\beta\text{X}_\gamma$ wherein M is Co and/or Ni, M' is at least one element selected from the group consisting of Nb, W, Ta, Zr, Hf, Ti and Mo, M'' is at least one element selected from the group consisting of V, Cr, Mn, Al, elements in the platinum group, Sc, Y, rare earth elements, Au, Zn, Sn and Re, X is at least one element selected from the group consisting of C, Ge, P, Ga, Sb, In, Be and As, and a, x, y, z, α , β , and γ , respectively, satisfy $0 \leq a \leq 0.5$, $0.1 \leq x \leq 3$, $0 \leq y \leq 30$, $0 \leq z \leq 25$, $5 \leq y+z \leq 30$, $0.1 \leq \alpha \leq 30$, $\beta \leq 10$ and $\gamma \leq 10$, at least 50% of the alloy structure being fine crystalline particles having an average particle size of 100 nm or less. This alloy is said to have low core loss, time variation of core loss, high permeability and low

magnetostriction. Yoshizawa et al. also discloses toroidal magnetic cores for use in various transformers, choke coils, saturable reactors, magnetic heads, and the like.

Applicants respectfully traverse the position of the Examiner that the '438 patent, Mischler et al., Frischmann, and Vernin et al. teach every aspect of the invention except the compositions set forth in claims 13 and 14. As set forth above in connection with the discussion concerning the rejection of claim 12 under 35 U.S.C. §103(a), applicants submit that the combination of the '438 patent, Mischler et al., Frischmann, and Vernin et al. does not suggest a stator having a plurality of segments, each segment comprising a plurality of layers of amorphous metal strips; each of which layers has a top and a bottom surface and is oriented such that (i) a line normal to either of the surfaces at substantially any point thereon is substantially perpendicular to the axis of rotation of the rotor, and (ii) when traversing the segment, the flux crosses one air gap, required by present claims 13 and 14.

Moreover, the Yoshizawa et al. disclosure does not have any teaching concerning the utility of any composition therein for the construction of electric motors or other rotating electrical machines. For the reasons set forth hereinabove in connection with the rejection of claim 12, applicants submit that a skilled artisan would not be motivated to combine the Yoshizawa et al. disclosure directed to electronic core applications with the Mischler et al, Frischmann, and '438 patent disclosures, as proposed by the Examiner.

However, even assuming that the combination of Yoshizawa et al. with the '438 patent, Mischler et al., Frischmann, and Vernin et al. could properly be made, it would not render obvious the stator called for by applicants' amended claims 13 and 14, because any stator produced in light of the combined teachings of the cited references would still lack the advantageous structure and properties afforded by applicants' stator, as recited by claims 13 and 14. More specifically, any

stator constructed from the combined teachings of the cited references would not contain in combination a structure having a plurality of layers of amorphous metal strips, each of which has a top and a bottom surface and is oriented such that (i) a line normal to either of the top and bottom surfaces at substantially any point thereon is substantially perpendicular to the axis of rotation of the rotor, and (ii) when traversing the segment, the flux crosses one air gap. Moreover, such a stator produced from the combined teachings of the cited references would clearly lack the advantageous magnetic properties afforded by the stator of applicants' amended claims 13 and 14. As set forth at page 16, lines 18-19 and 27-29 of applicants' specification, stators employing nanocrystalline alloy strip are especially preferred for motors wherein minimum size and high-speed operation are desired.

Accordingly, reconsideration of the rejection of claims 13 and 14 under 35 U.S.C. §103(a) over the combination of the '438 patent, Mischler et al., Frischmann, and Vernin et al., with Yoshizawa et al. is respectfully requested.

Claims 15-18, 26-33, and 36 have been rejected under 35 U.S.C. §103(a) as being unpatentable over the '438 patent and Mischler et al. The Examiner has indicated that the '438 patent and Mischler et al. teach every aspect of the invention except the core loss and frequency range of the magnetic material, and it would be obvious to the skilled artisan to construct the stator core of the '438 patent and Mischler et al. to optimize the magnetic characteristics of the amorphous material.

Applicants respectfully traverse this statement. As discussed hereinabove in connection with the rejection of claims 1, 2, 3, 8, 19-22, and 35 over the combination of the '438 patent and Mischler et al., each of claims 15-18, 26-33, and 36 recites a stator having a plurality of segments. Each segment comprises a plurality of layers of amorphous metal strips, and each of layer of strip

has a top and a bottom surface and is oriented such that (i) a line normal to either of the surfaces at substantially any point thereon is substantially perpendicular to the axis of rotation of the rotor, and (ii) when traversing the segment, the flux crosses one air gap. Clearly, this combination of structural elements is not disclosed or suggested by the combination of the '438 patent and Mischler et al. In fact, as previously noted, the proposed combination of '438 patent and Mischler et al. teaches away from the stator structure that contains the elements of provisos (i) and (ii).

Moreover, applicants respectfully disagree that claims 15-18, 26-33, and 36 amount merely to optimization of magnetic characteristics of a core. Clearly, the advantageously low core loss afforded by applicants' amorphous magnetic component is a result; not a design choice that the skilled worker can readily "dial up" on command. It is therefore submitted that amended claims 15-18, 26-33, and 36 are patentable over the combination of the '438 patent and Mischler et al.

Accordingly, reconsideration of the rejection of claims 15-18, 26-33, and 36 under 35 U.S.C. §103(a) as being unpatentable over the '438 patent and Mischler et al. is respectfully requested.

Claims 19-21 and 28-30 have been rejected under 35 U.S.C. §103(a) as being unpatentable over the '438 patent and Mischler et al. in further view of U.S. Patent No. 4,763,030 to Clark et al.

The Clark et al. patent discloses a metallic glass ribbon having the formula $Fe_wB_xSi_yC_z$ wherein $0.78 \leq w \leq 0.83$, $0.13 \leq x \leq 0.17$, $0.03 \leq y \leq 0.07$, $0.005 \leq z \leq 0.03$, and $w+x+y+z=1$. The ribbon is annealed to remove mechanical strains and exposed to a magnetic field in the plane of the ribbon and transverse to the long axis of the ribbon. The resulting metallic glass ribbons have very large magnetic coupling coefficients ($k_{33} > 0.9$). The treated ribbons are said to be useful in magnetostrictive transducers and in passive listening devices such as hydrophones or pressure sensors. No disclosure is provided by the Clark et al patent of the use of metallic glass or

amorphous metal ribbon in the construction of components of electric motors. Moreover there is no suggestion in Clark et al. that amorphous metal ribbons having high magnetomechanical coupling factor are advantageous for use in construction of an electric motor.

The Examiner has stated that the '438 patent and Mischler et al. teach every aspect of the invention, except the heat treatment, application of a magnetic field, and annealing the segments. This statement is respectfully traversed. As discussed hereinabove in connection with the 103(a) rejection of claims 1, 2, 3, 8, 19-22, and 35 over the '438 patent and Mischler, present claim 1 calls for a stator comprised of segments. Each of the segments comprises a plurality of layers of amorphous metal strips, and each of the strips has a top and a bottom surface and is oriented such that (i) a line normal to either of the surfaces at substantially any point thereon is substantially perpendicular to the axis of rotation of the rotor, and (ii) when traversing the segment, the flux crosses one air gap. Even taking together the '438 patent and Mischler et al. teachings, there is no suggestion therein concerning a stator that satisfies the combined features of provisos (i) and (ii). Clark et al. do not disclose or suggest use of amorphous metal in electric motor components of any kind, let alone construction of the amorphous metal stator set forth in present claims 1, 2, 3, 8, 19-22, and 35. Clearly, a stator constructed in accordance with the combined teaching of the '438 patent and Mischler et al, even if annealed in the manner taught by Clark et al., would still lack the advantageous combination of structure and properties afforded by applicants' stator, as recited by claims 19-21 and 28-30. The stator would not comprise amorphous metal strips oriented such that, when traversing a segment, the flux crosses one air gap, as required by present claims 19-21 and 28-30 wherein the flux crosses only one air gap. It would not comprise amorphous metal strips oriented such that a line normal to either of the surfaces at substantially any point thereon is substantially perpendicular to the axis of rotation of the rotor. Thus, the Clark et al. teaching does

not add to the teachings of the '438 patent and Mischler et al. and cannot be combined therewith to render obvious the invention recited by present claims 19-21 and 28-30.

The Examiner further indicates that claims 28-30 are method of making limitations which are not germane to the patentability of the apparatus. As discussed hereinabove in conjunction with the rejection of claims 1, 2, 3, 8, 19-22, and 35 under 35 U.S.C. § 103(a), applicants respectfully submit that heat treatment or annealing, whether or not a magnetic field is applied, is a structural feature of the stator recited in claims 28-30 also and is thus properly germane to the determination of patentability of those claims. The Examiner has suggested that Clark, along with Yoshizawa and Vernin merely support Mischler to teach various elements of the amorphous material in magnetic cores. Applicants acknowledge that each of Clark, Yoshizawa, and Vernin provide teachings concerning amorphous metals. However, applicants respectfully submit that the Examiner has not pointed to those elements in either of Clark, Yoshizawa, or Vernin that fairly disclose or suggest the particular features and properties set forth in applicants' amended claims 19-21 and 28-30.

Accordingly, reconsideration of the rejection of claims 19-21 and 28-30 under 35 U.S.C. §103(a) over the '438 patent, Mischler et al. and Clark et al. is respectfully requested.

In view of the amendment to Fig. 4B and the remarks set forth above, it is submitted that the present application is in allowable condition. Reconsideration of the rejection of claims 1-36, entry of the present amendment, and allowance of the application are, therefore, earnestly solicited.

Respectfully submitted,
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Fig. A2
 (DE 2805438)

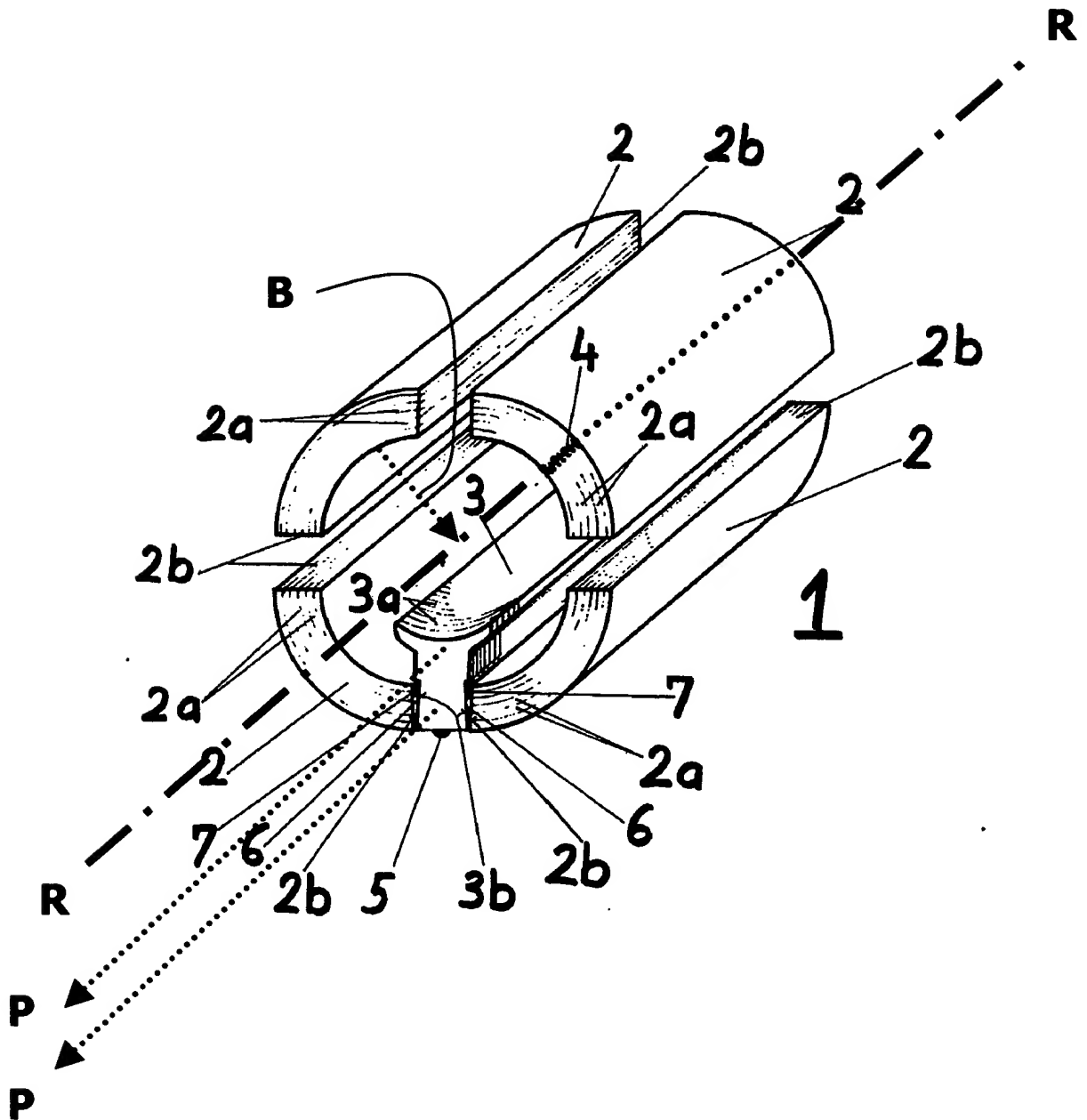




Fig. A3
(DE 2805438)

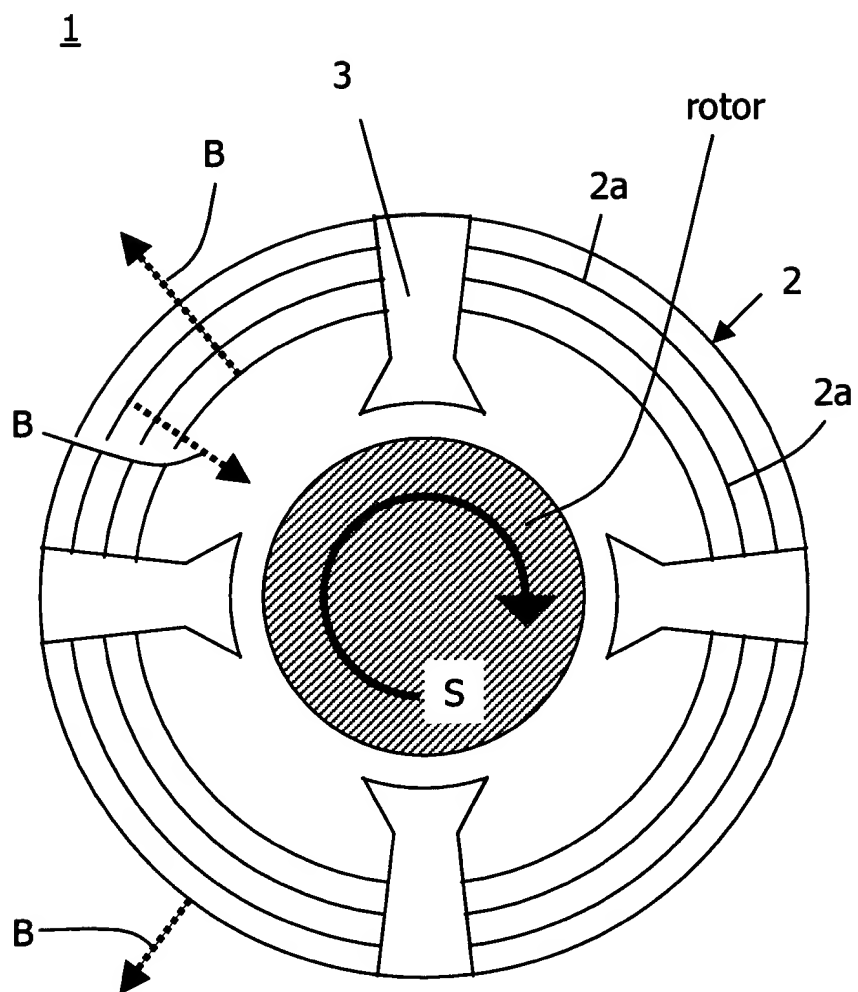




Fig. A5
(DE 2805438)

